

REMARKS

A. Request for Reconsideration

Applicant has carefully considered the matters raised by the Examiner in the outstanding Office Action but remains of the position that patentable subject matter is present. Applicant respectfully requests reconsideration of the Examiner's position based on the amendments to the specification, the amendments to the claims and the following remarks.

B. The Invention

The present invention is directed to a UV ray curable ink and image forming method utilizing the ink. In one of the novel aspects of the invention, the absolute value of difference between the ink viscosity at 25 °C with a shear rate of 10 (1/s) and the ink viscosity at 25 °C with a shear rate of 1000 (1/s) is not more than 5 mPa·s. In another novel aspect of the invention, a polymer dispersant is added to the ink to disperse the pigment thereby lowering the dependency of the ink viscosity on the shear rate (page 38, lines 1-6 and page 40, lines 17-19).

C. Claim Status and Amendments

Claims 1-20 are presented for further prosecution.

Claim 1 has been amended to recite that the ink contains a polymer dispersant. Support for this amendment can be found at page 38, lines 1-6 and at page 40, lines 17-19.

Claim 7 has been amended to recite that the cation polymerizable compound is composed of at least one of "either" an epoxy compound and a vinyl ether compound. Support for this amendment can be found at page 15, lines 4-14 where epoxy compounds and vinyl ether compounds are used in the alternative.

D. Specification Amendments

A section entitled "Brief Description of the Drawings" has been added. Support for the description of Figures 1 and 2(a)-2(c) can be found at page 46, lines 9-10, page 50, line 15, page 50, line 21 and page 51, line 5.

E. Objection to the Specification

The disclosure had been objected to for omitting a brief description of the drawings. A description has been added to page 3 of the specification.

F. Rejections under 35 USC § 112

Claim 7 had been rejected as being indefinite. The Examiner had stated that it is unclear whether the cation polymerizable compound includes either or both the epoxy compound and the vinyl ether compound.

Claim 7 has been amended to recite that "either" the epoxy compound or the vinyl ether compound is present. In other words, the polymerizable compound can contain either the epoxy compound, the vinyl compound or both the epoxy compound and the vinyl compound. It is deemed that claim 7 now complies with section 112.

G. Rejections under 35 USC 102(b)

Claims 1-20 had been rejected as being anticipated by Laksin (US 6,232,361). Claims 1-8 and 14-20 had been rejected as being anticipated by Sanenobu (JP2001-220526). Laksin and Sanenobu had been each cited to teach a radiation curable ink composed of a pigment, a polymerizable compound and an initiator. A computer translation of Sanenobu is enclosed for the Examiner's reference since the English Abstract and the Japanese specification of Sanenobu had been provided with the Office Action.

1. Laksin and Sanenobu do not teach an ink containing the polymer dispersant of claim 1

The Inventor has discovered that an ink satisfying the viscosity range of claim 1 provides stability in the ink channels, prevents ink dwell, provides stable ink ejection and lowers initial ink jet velocity (page 12, lines 3-15).

The viscosity of the ink viscosity is greatly affected by the shear rate of the ink (page 10, lines 15-17). The Inventor has found that the viscosity of the ink becomes less dependent on the shear rate when the ink contains a polymer dispersant (page 40, lines 17-19). Claim 1 has been amended to recite the polymer dispersant as discussed above.

Laksin and Sanenobu do not teach or suggest the viscosity range of claim 1 or the benefits that result from satisfying this range. Furthermore, Laksin and Sanenobu do not teach or suggest adding the polymer dispersant of claim 1 to the ink to lower the dependency of the ink viscosity on the shear rate. It is respectfully submitted that Laksin and Sanenobu do not anticipate amended claim 1.

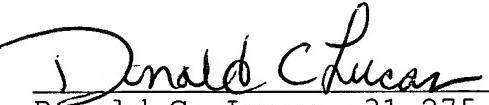
H. Conclusion

In view of the foregoing and the enclosed, it is respectfully submitted that the application is in condition for allowance and such action is respectfully requested. Should any extensions of time or fees be necessary in order to maintain this Application in pending condition, appropriate requests are hereby made and authorization is given to debit Account # 02-2275.

Respectfully submitted,

MUSERLIAN, LUCAS & MERCANTI, LLP

By:


Donald C. Lucas, 31,275
Attorney for Applicant(s)
475 Park Avenue South, 15th Floor
New York, New York
Tel. # 212-661-8000

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(72)Inventor : MAEDA SANENOBU

(54) ENERGY RAY-CURABLE COMPOSITION FOR INK JET RECORDING SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an energy ray-curable composition having excellent functions as an ink for ink jet recording system.

SOLUTION: This composition contains (1) a cationic photopolymerization initiator, (2) a compound having at least one oxirane group, (3) a vinyl ether compound, and (4) an oxetane compound having hydroxy group provided that the amount of ingredient B is 47-63 wt.% of the sum of ingredients (2), (3), and (4).

LEGAL STATUS

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3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the energy-line hardening setup-of-tooling product for ink jet recording methods which has the good ink engine performance.

[0002]

[Description of the Prior Art] Conventionally, the energy-line hardening setup-of-tooling product hardened by irradiating energy lines, such as ultraviolet rays, is used for the ink of the printer for screen-stencil. Since the diluent solvent is not being used for such an energy-line hardening setup-of-tooling product, it is usually excellent in fast curability, and it is suitable for especially carrying out coating printing at a metal, plastics, etc.

[0003]

[Problem(s) to be Solved by the Invention] By the way, when you want to use this printer for ink jet recording methods for a metal, plastics, etc., and to print with the improvement in technical of the printer for ink jet recording methods in recent years, requests are mounting. Although it was possible to use an above-mentioned energy-line hardening setup-of-tooling product as ink also here, since viscosity was high, it was stabilized from the printer head and there was a problem that the regurgitation was not carried out. Although diluting with a solvent and lowering viscosity that this problem should be solved was also considered, since fast curability was inferior when it dilutes with a solvent, there was a problem of not being desirable on a printing property.

[0004] On the other hand, the energy-line hardening setup-of-tooling product which consists of the compound which has one oxetane ring and one hydroxyl group in a molecule, a compound which has one or more oxirane rings in a molecule, and an optical cationic initiator is indicated by JP,9-31186,A. This constituent has adhesion smooth [a hardening paint film] and good, has fast curability, and can use it for printing ink etc.

[0005] However, although the energy-line hardening setup-of-tooling product indicated by above-mentioned JP,9-31186,A was useful as an object for screen-stencil, when it saw as an object for ink jet recording methods, since viscosity was still high, it had the problem that the regurgitation could not be stabilized and carried out from a printer head.

[0006] It makes for this invention to solve the above-mentioned trouble into a technical problem, and aims at offering the energy-line hardening setup-of-tooling product equipped with the engine performance which was excellent as ink for ink jet recording methods.

[0007]

[The gestalt and effect of the invention] of implementation of The means for solving a technical problem and invention In order to solve the above-mentioned technical problem, the energy-line hardening setup-of-tooling product for ink jet recording methods of this invention (1) An optical cationic initiator and the compound which has one or more oxirane radicals in (2) molecules, (3) It is characterized by the rate that contains a vinyl ether compound and the compound which has an oxetane ring and one hydroxyl group in (4) molecules, and the above-mentioned component (2) occupies to the AUW of above-mentioned component (2) - (4) being 47 - 63 % of the weight.

[0008] The constituent of this invention has the good regurgitation stability of the ink when using it for the printer head of the printer for ink jet recording methods, since viscosity is sufficiently low compared with the former. Moreover, although viscosity is low, if an energy line is irradiated, it hardens quickly and the adhesion after hardening, flexibility, and surface hardness are also good.

[0009] Although it can be used without limiting especially if it is the compound known conventionally as the component used for this invention (1), i.e., an optical cationic initiator, aromatic series iodonium complex salt,

aromatic series sulfonium complex salt, etc. can be mentioned, for example, and although these one sort may be used independently, you may use it, combining two or more sorts suitably.

[0010] As an example of aromatic series iodonium, diphenyliodonium, 4-methoxy diphenyliodonium, screw (4-methylphenyl) iodonium, screw (4-tert-butylphenyl) iodonium, screw (dodecyl phenyl) iodonium, etc. are mentioned. moreover, as an example of aromatic series sulfonium Triphenylsulfonium, diphenyl-4-thio phenoxyphenyl sulfonium, A screw [4-(diphenyl SURUFONIO)-phenyl] sulfide, a screw [4-(JI (4-(2-hydroxyethyl) phenyl) SURUHONIO)-phenyl] sulfide, eta5-2 and 4-(cyclo pen TAJIENIRU) [1, 2, 3, 4, 5, and 6-eta-(methyl-ethyl)-benzene]-iron (1+) etc. is mentioned.

[0011] As an example of the counter anion which forms complex salt, tetrafluoroborate (BF₄-), hexafluorophosphate (PF₆-), hexafluoroantimonate (SbF₆-), hexafluoroarsenate (AsF₆-), hexa chloro antimonate (SbCl₆-), etc. are mentioned.

[0012] As for especially the component (1) used for this invention, it is desirable to use it in 0.1 - 10% of the weight of the range 0.01 to 20% of the weight as opposed to the AUW of component (2) - (4). If too little [this component (1) / too], a constituent cannot fully be stiffened, and when too excessive, it becomes impossible for light transmission nature to become a defect and to stiffen homogeneity.

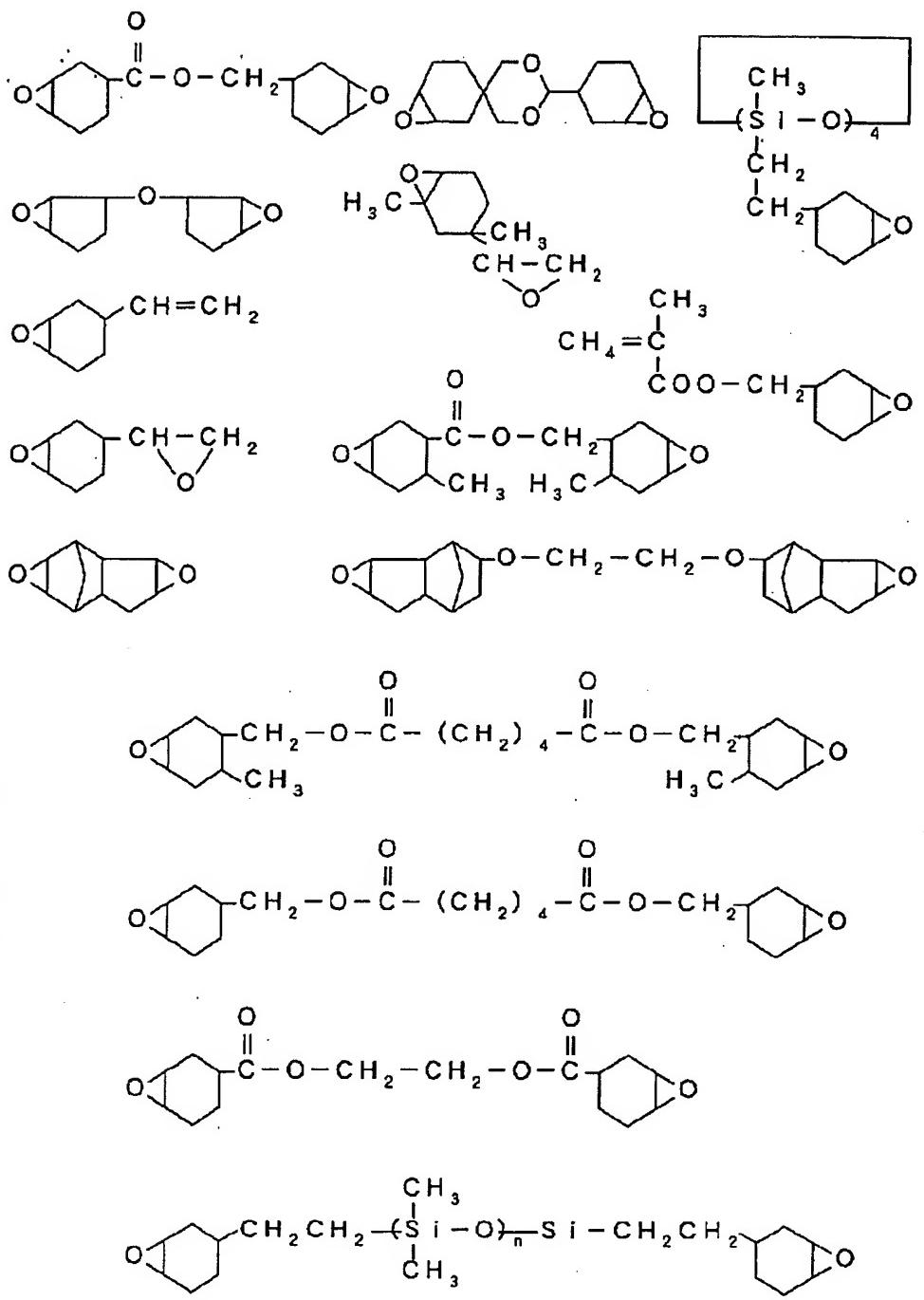
[0013] As a compound which has one or more oxirane radicals, the monomer of a compound which has an oxirane radical, and all of the oligomer can be used into the component used for this invention (2), i.e., a molecule. Well-known aromatic series epoxide, alicyclic epoxide, and aliphatic series epoxide are mentioned concrete conventionally. In addition, epoxide means a monomer or its oligomer below. As oligomer in this invention, the compound of low molecular weight is desirable and less than 1000 oligomer has more desirable molecular weight.

[0014] A thing desirable as aromatic series epoxide is JI or poly glycidyl ether manufactured by the reaction of the polyhydric phenol which has at least one aromatic series nucleus, or its alkylene oxide adduct and epichlorohydrin, for example, JI of JI of bisphenol A or its alkylene oxide adduct or poly glycidyl ether, hydrogenation bisphenol A, or its alkylene oxide adduct or poly glycidyl ether, a novolak mold epoxy resin, etc. are mentioned. Ethyleneoxide, propylene oxide, etc. are mentioned as alkylene oxide here.

[0015] As alicyclic epoxide, the cyclohexene oxide or the cyclopentene oxide content compound therefore obtained by carrying out epoxidation of the compound which has cycloalkane rings, such as KISEN or a cyclopentene ring, to at least one cyclo with suitable oxidizers, such as a hydrogen peroxide and a peroxy acid, is desirable, and the compound shown below as an example is mentioned.

[0016]

[Formula 1]



[0017] JI or poly glycidyl ether of aliphatic series polyhydric alcohol or its alkylene oxide adduct etc. is one of desirable things of aliphatic series epoxide. As the example of representation The diglycidyl ether of alkylene glycol, such as diglycidyl ether of ethylene glycol, diglycidyl ether of propylene glycol, or diglycidyl ether of 1,6-hexanediol, The poly glycidyl ether of polyhydric alcohol, such as JI of a glycerol or its alkylene oxide adduct, or triglycidyl ether, The diglycidyl ether of polyalkylene glycols, such as diglycidyl ether of the diglycidyl ether of a polyethylene glycol or its alkylene oxide adduct, a polypropylene glycol, or its alkylene oxide adduct, etc. is mentioned. Ethyleneoxide, propylene oxide, etc. are mentioned as alkylene oxide here.

[0018] Furthermore, the monoglycidyl ether of the monoglycidyl ether of the aliphatic series higher alcohol which is the monomer which has one oxirane ring and a phenol, and cresol etc. can be used for the intramolecular ether than these compounds. When fast curability is taken into consideration among these epoxide, aromatic series epoxide and alicyclic epoxide are desirable, and especially alicyclic epoxide is desirable. In this invention, although one sort of the above-mentioned epoxide may be used independently, you may use it, combining two or more sorts suitably:

[0019] As the component used for this invention (3), i.e., a vinyl ether compound For example, the ethylene glycol divinyl ether, the diethylene-glycol divinyl ether, Triethylene glycol divinyl ether, the propylene glycol

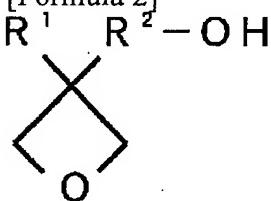
divinyl ether, Dipropylene glycol divinyl ether, the butanediol divinyl ether, The hexandiol divinyl ether, the cyclohexane dimethanol divinyl ether, JI or TORIBI nil ether compounds, such as the trimethylol propane TORIBI nil ether, Ethyl vinyl ether, n-butyl vinyl ether, isobutyl vinyl ether, Octadecyl vinyl ether, cyclohexyl vinyl ether, hydroxy butyl vinyl ether, 2-ethylhexyl vinyl ether, cyclohexane dimethanol mono-vinyl ether, n-propyl vinyl ether, isopropyl vinyl ether, and isopropenyl ether-O-propylene carbonate, Mono-vinyl ether compounds, such as dodecyl vinyl ether, diethylene-glycol mono-vinyl ether, and octadecyl vinyl ether, etc. are mentioned.

[0020] When hardenability, adhesion, and surface hardness are taken into consideration among these vinyl ether compounds, JI or a TORIBI nil ether compound is desirable, and especially a divinyl ether compound is desirable. In this invention, although one sort of the above-mentioned vinyl ether compound may be used independently, you may use it, combining two or more sorts suitably.

[0021] As the component used for this invention (4), i.e., a compound which has an oxetane ring and one hydroxyl group in a molecule, the compound expressed with the following formula, for example can be mentioned.

[0022]

[Formula 2]



[0023] Here, in the above-mentioned formula, R1 is the alkyl group which has the straight chain of 1-6 carbon numbers, such as a hydrogen atom, a methyl group, an ethyl group, a propyl group, or butyl, or branching, the fluoro alkyl group of 1-6 carbon numbers, an allyl group, an aryl group, a furil radical, or a thietyl group. R2 may be an alkylene group which has the straight chain of 1-6 carbon numbers or branching of methylene, ethylene, a propylene, or a butylene, and this alkylene group may be oxy-alkylene groups, such as the radical which has ether linkage, for example, oxy-methylene, oxyethylene, oxypropylene, and an oxy-butylene. If fast curability, adhesion, and surface hardness are taken into consideration among these compounds, in the above-mentioned formula (1), as R1, the alkyl group of 1-6 carbon numbers is desirable, and especially the alkyl group of 1-3 carbon numbers is desirable. Moreover, as R2, the hydroxyalkyl radical of 1-6 carbon numbers, especially the hydroxyalkyl radical of 1-3 carbon numbers are desirable.

[0024] As an example of a compound expressed with the above-mentioned formula, 3-hydroxymethyl-3-methyl oxetane, 3-hydroxymethyl-3-ethyl oxetane, 3-hydroxymethyl-3-propyl oxetane, 3-hydroxymethyl-3-normal butyl oxetane, 3-hydroxymethyl-3-phenyl oxetane, 3-hydroxymethyl-3-benzyl oxetane, 3-hydroxyethyl-3-methyl oxetane, 3-hydroxyethyl-3-ethyl oxetane, 3-hydroxyethyl-3-propyl oxetane, 3-hydroxyethyl-3-phenyl oxetane, 3-hydroxypropyl-3-methyl oxetane, 3-hydroxypropyl-3-ethyl oxetane, 3-hydroxypropyl-3-propyl oxetane, 3-hydroxypropyl-3-phenyl oxetane, 3-hydroxy butyl-3-methyl oxetane, etc. can be mentioned. 3-hydroxymethyl-3-methyl oxetane and 3-hydroxymethyl-3-ethyl oxetane are desirable as an oxetane monoalcohol compound from points, such as the ease of acquisition, among these compounds.

[0025] In this invention, although one sort of the above-mentioned compound may be used independently, you may use it, combining two or more sorts suitably. The energy-line hardening setup-of-tooling product for ink jet recording methods of this invention needs to satisfy the following engine performance. Namely, it is the viscosity of extent in which ink carries out the regurgitation to stability from the printer head of the printer for ink jet recording methods the 1st, i.e., low viscosity, the 2nd -- from a printer head -- breathing out -- print media (paper and plastics --) With an energy line, the ink adhering to a metal etc. reacts promptly and hardens, i.e., fast curability. It needs to be satisfied with the 3rd of engine performance, such as not spreading, when the ink after printing rubs against the ink after printing not separating easily from print media, i.e., adhesion, and the 4th, i.e., high degree-of-hardness nature etc.

[0026] Therefore, in this invention, the rate that the above-mentioned component (2) occupies is limited to 47-63% of the weight of the range to the AUW of above-mentioned component (2) - (4): Hypoviscosity (for example, 35 or less mPa-s) to which ink does not invite by this the fault of not carrying out the regurgitation from the printer head for ink jet recording methods is realized. Moreover, the engine performance which was

very excellent also about fast curability, adhesion, or a degree of hardness is shown. Although it incidentally has low viscosity when the above-mentioned rate is less than 47 % of the weight, since the engine performance deteriorates in respect of fast curability or adhesion, if the above-mentioned rate exceeds 63 % of the weight, since low viscosity cannot be maintained but it will no longer be breathed out by stability from the printer head for ink jet recording methods, it is not desirable preferably.

[0027] In this invention, if it is going to acquire the further excellent regurgitation stability, it is desirable to limit the above-mentioned rate to 48 - 53% of the weight of the range. In this case, holding fast curability, adhesion, and the engine performance that was [about the degree of hardness] excellent as it is, since hypoviscosity (for example, 20 or less mPa·s) which was not able to be realized conventionally is realized, it is desirable.

[0028] By the way, although above-mentioned component (2) - (4) causes and macromolecule-izes an optical cationic polymerization reaction if energy lines, such as ultraviolet rays, are irradiated by each under existence of an optical cationic polymerization agent It is because it took into consideration that having made these three components indispensable had the engine performance which was synthetically excellent as a constituent for ink jet recording methods by compensating the engine performance and a property with each disadvantageous component by another component.

[0029] Generally, although the compound which has one or more oxirane radicals in the above-mentioned component (2), i.e., a molecule, showed the property excellent in thermal resistance, an adhesive property, and chemical resistance, specifically, it had the fault that a cure rate was slow and viscosity was high. Moreover, although the above-mentioned component (3), i.e., a vinyl ether compound, generally showed the property excellent in fast curability and low viscosity, it had the fault of being easy to volatilize. Furthermore, generally the compound which has an oxetane ring and one hydroxyl group in the above-mentioned component (4), i.e., a molecule, shows the property excellent in a water resisting property, moisture resistance, kinetic property, and fast curability.

[0030] Although not using the above-mentioned component (4) but combining the above-mentioned component (2) and the above-mentioned component (3) here is also considered, since it is in the inclination for fast curability not to be acquired enough in that case, and for a degree of hardness to change too much softly, in order to conquer these, there is meaning which combines the above-mentioned component (4) preferably.

[0031] Moreover, although not using the above-mentioned component (3) but combining the above-mentioned component (2) and the above-mentioned component (4) is also considered, as a constituent for ink jet recording methods, regurgitation stability is a very important factor, and since to be remarkable hypoviscosity is demanded in order to acquire the outstanding regurgitation stability, there is meaning which combines the viscous low above-mentioned component (3) further compared with the above-mentioned component (4).

[0032] In order to compensate each disadvantageous engine performance and property from such a viewpoint, employing each advantageous engine performance and property of above-mentioned component (2) - (4) efficiently The above (2) It is desirable that the rate that the above-mentioned component (4) occupies [the rate that the above-mentioned component (3) occupies / the rate that the above-mentioned component (2) occupies / to the AUW of three components of - (4) 47 to 63% of the weight (especially 48 - 53 % of the weight)] 17 to 51.5% of the weight is 0.5 - 20 % of the weight. Since there is a possibility that the engine performance and a property with each advantageous component may not fully be employed efficiently, and each disadvantageous engine performance and property may surface when it is less than a lower limit per each component or exceeds a upper limit, it is not desirable.

[0033] In addition to above-mentioned component (1) - (4), the energy-line hardening setup-of-tooling product for ink jet recording methods of this invention may contain (5) light radical polymerization initiator and (6) ethylene nature radical polymerization nature unsaturated compound further. Although same engine performance and property are acquired also in this case, since the combination of a component is diversified by containing a component (5) and (6), there is an advantage that the degree of freedom of a design spreads.

[0034] Although it can be used without limiting especially if it is the compound known conventionally as the component used for this invention (5), i.e., an optical radical polymerization initiator, benzyl or its dialkyl acetal system compound, an acetophenone system compound, a benzoin or its alkyl ether system compound, a benzophenone system compound, a thioxan ton system compound, etc. can be mentioned, for example.

[0035] Specifically as benzyl or its dialkyl acetal system compound, benzyl dimethyl ketal, a benzyl-beta-methoxy ethyl acetal, 1-hydroxy cyclohexyl phenyl ketone, etc. can be mentioned, for example. Moreover, as

an acetophenone system compound, diethoxy acetophenone and 2-hydroxymethyl-1-phenyl propane-1-ON, 4'-isopropyl-2-hydroxy-2-methyl-propiophenone, 2-hydroxy-2-methyl-propiophenone, p-dimethylamino acetophenone, a p-tert-butyl dichloro acetophenone, p-tert-BUCHIRUTORI chloroacetophenone, p-azide benzal acetophenone, etc. can be mentioned, for example. And as a benzoin system compound, a benzoin, benzoin methyl ether, benzoin ethyl ether, benzoin iso-propyl ether, benzoin normal butyl ether, benzoin isobutyl ether, etc. can be mentioned, for example. Moreover, as a benzophenone system compound, a benzophenone, methyl o-benzoylbenzoate, MIHIRASU ketone, 4, and 4'-bis-diethylamino benzophenone, 4, and 4'-dichloro benzophenone etc. can be mentioned, for example. And as a thioxan ton system compound, a thioxan ton, 2-methylthio xanthone, 2-ethyl thioxan ton, 2-chloro thioxan ton, 2-isopropyl thioxan ton, etc. can be mentioned, for example. In this invention, it can be used according to the desired engine performance, being able to blend one sort or two sorts or more of radical polymerization initiators.

[0036] Although it can be used without limiting especially if it is the compound known conventionally as the component used for this invention (6), i.e., an ethylene nature radical polymerization nature unsaturated compound, an acrylate (meta) system compound, an unsaturated polyester compound, an allyl compound urethane system compound, the Pori thiol compounds, etc. can be mentioned, and 1 of sorts of these and two sorts or more can be used, for example. Among those, but the compound which has at least one acrylic (meta) radical is preferably used into 1 molecule, for example, the resultant of an epoxy compound and an acrylic acid (meta), the acrylic ester (meta) of alcohols, urethane (meta) acrylate, polyester (meta) acrylate, polyether (meta) acrylate, etc. can be mentioned as an example.

[0037] As a resultant of the above-mentioned epoxy compound and the above-mentioned acrylic acid (meta), an aromatic series epoxy compound, an alicycle group epoxy compound and/or an aliphatic series epoxy compound, and the acrylate system resultant acquired by the reaction with an acrylic acid (meta) (meta) can be mentioned. Also among the above-mentioned acrylate (meta) system resultants, the acrylate system resultant acquired by the reaction of an aromatic series epoxy compound and an acrylic acid (meta) (meta) is used preferably. As an example, the glycidyl ether obtained by the reaction of bisphenol compounds, such as bisphenol A and Bisphenol S, or the alkylene oxide addition product of those, and epoxidation agents, such as epichlorohydrin (Meta) The acrylate system resultant which the acrylate and the epoxy novolak resin which are made to react with an acrylic acid and are obtained (meta), and an acrylic acid (meta) are made to react, and is acquired (meta) can be mentioned.

[0038] Moreover, the acrylate obtained as acrylic ester (meta) of the above-mentioned alcohols by the reaction of the aromatic alcohol which has at least one hydroxyl group in a molecule, fatty alcohol, alicycle group alcohol and/or those alkylene oxide adducts, and an acrylic acid (meta) (meta) can be mentioned. More specifically For example, 2-ethylhexyl (meta) acrylate, 2-hydroxyethyl (meta) acrylate, 2-hydroxypropyl (meta) acrylate, Lauryl (meta) acrylate, stearyl (meta) acrylate, Iso octyl (meta) acrylate, tetrahydrofurfuryl (meta) acrylate, Isobornyl (meta) acrylate, benzyl (meta) acrylate, 1, 4-butane JIORUJI (meta) acrylate, 1, 6-hexane JIORUJI (meta) acrylate, Diethylene GURIKORUJI (meta) acrylate, TORIECHIRENGURIKORUJI (meta) acrylate, Tripropylene GURIKORUJI (meta) acrylate, neopentyl GURIKORUJI (meta) acrylate, Polyethylene GURIKORUJI (meta) acrylate, polypropylene GURIKORUJI (meta) acrylate, TORIMECHI roll pro pantry (meta) acrylate, pen TAERISURITORUTORI (meta) acrylate, The acrylate (meta) of the alkylene oxide addition product of polyhydric alcohol, such as dipentaerythritol hexa (meta) acrylate, the above-mentioned diol, triol, tetra-oar, and hexa oar, etc. can be mentioned. among those -- also coming out -- as acrylate (meta) of alcohols, the acrylate which has two or more acrylic (meta) radicals (meta) is preferably used into 1 molecule obtained by the reaction of polyhydric alcohol and an acrylic acid (meta). Moreover, an acrylate compound is preferably used from the point of a rate of polymerization rather than a methacrylate compound among acrylate (meta) compounds.

[0039] Moreover, the acrylate which hydroxyl-group content (meta) acrylic ester and an isocyanate compound are made to react, and is obtained as urethane (meta) acrylate, for example (meta) can be mentioned. As hydroxyl-group content (meta) acrylic ester, the hydroxyl-group content (meta) acrylic ester obtained by the esterification reaction of aliphatic series dihydric alcohol and an acrylic acid (meta) is desirable, and can mention 2-hydroxyethyl (meta) acrylate etc. as an example. Moreover, the poly isocyanate compound which has two or more isocyanate radicals in 1 molecules, such as tolylene diisocyanate, hexamethylene di-isocyanate, and isophorone diisocyanate, as the above-mentioned isocyanate compound is desirable.

[0040] Furthermore, as polyester (meta) acrylate, the polyester (meta) acrylate obtained by the reaction of

hydroxyl-group content polyester and an acrylic acid (meta) can be mentioned. Moreover, as the above-mentioned polyether (meta) acrylate, the polyether acrylate obtained by the reaction of a hydroxyl-group content polyether and an acrylic acid can be mentioned.

[0041] The energy-line hardening setup-of-tooling product for ink jet recording methods of this invention may be carrying out optimum dose content of one sort, such as coloring agents (a color, pigment, etc.), bulking agents (a silica, glass powder, ceramic powder, metal powder, etc.), a defoaming agent, a flame retarder, and an antioxidant, or the two sorts or more if needed, unless the effectiveness of this invention other than each above-mentioned component is spoiled.

[0042] What is necessary is to carry out heating fusion of the component, and just to mix with other liquefied components that what is necessary is just to mix in ordinary temperature when each above-mentioned component is liquefied in ordinary temperature, when there is a solid component in ordinary temperature in order to manufacture the energy-line hardening setup-of-tooling product for ink jet recording methods of this invention. In order to use the energy-line hardening setup-of-tooling product for ink jet recording methods of this invention, this constituent is first supplied to the printer head of the printer for ink jet recording methods, and activity energy lines, such as ultraviolet rays or an electron ray, are irradiated discharge and after that from this printer head on print media (base materials, such as a metal, rubber, plastics, shaping components, a film, paper, a tree, glass, cloth, concrete, and a ceramic). This hardens the constituent on print media promptly.

[0043] In addition, as the light source of an activity energy line, when irradiating ultraviolet rays, for example, a mercury arc lamp, a xenon arc lamp, a fluorescence lamp, a carbon arc lamp, a tungsten-halogen copy lamp, and sunlight can be used. When irradiating ultraviolet rays, the exposure reinforcement to a base material is a 0.01 W square centimeter at least, and it is usually desirable to harden continuously with paper or a metal coating line by hardening a constituent within 1 - 20 seconds. Although it is made to usually harden with the electron ray of the following 300eV energy when making it harden with an electron ray, it is possible to also make it harden with the exposure of 1 - 5Mrad in an instant.

[0044]

[Example] Component (1) - (6) in the following explanation is in agreement with component [of a claim] (1) - (6). That is, an optical radical polymerization initiator and the component (6) of the compound with which the compound with which a component (1) has an optical cationic initiator in a molecule, and a component (2) has one or more oxirane radicals, and a component (3) have a vinyl ether compound in a molecule, and a component (4) has an oxetane ring and one hydroxyl group, and a component (5) are ethylene nature radical polymerization nature unsaturated compounds.

[0045] [Experiment No.1-12] experiment No.1 - component [per 12] (2) - (4) was shown in the following table 1, and weight section weighing capacity was carried out, it mixed, the mixture was moved to the dark room, the component (1) was added into the mixture in the dark room, and it considered as the energy-line hardening setup-of-tooling product for ink jet recording methods. In addition, the whole of each component used here was mixed at the room temperature, without carrying out heating fusion at a room temperature, since it was liquefied.

[0046] Viscosity, regurgitation stability, hardenability (pass), a pencil degree of hardness, adhesion, and flexibility were investigated about the class product. The result is shown in the lower berth of Table 1.

[0047]

[Table 1]

成分	商品名	NO. 1	NO. 2	NO. 3	NO. 4	NO. 5	NO. 6	NO. 7	NO. 8	NO. 9	NO. 10	NO. 11	NO. 12
(1)	UVI-6990 ^{*1}	6	6	6	6	6	6	6	6	6	6	6	6
(2)	UVR-6110 ^{*2}	45	46	47	48	49	50	60	62	65	70	100	60
(3)	DVE-3 ^{*3}	40	40	40	40	40	40	30	28	25	20	—	40
(4)	EOXA ^{*4}	15	14	13	12	11	10	10	10	10	10	—	—
(5)	APG-200 ^{*5}	—	—	—	—	—	—	—	—	—	—	—	—
(6)	IRGACURE651 ^{*6}	—	—	—	—	—	—	—	—	—	—	—	—
物 性	粘度(mPa·s)	13.2	14.1	14.6	15.0	15.9	17.7	25.4	34.4	40.5	50.6	299.4	22.2
	吐出安定性	○	○	○	○	○	○	△	△	×	×	×	△
	硬化性(アス入)	3	2	2	1	1	1	1	1	1	1	1	2
	鉛筆硬度	B	B	B	HB	HB	HB	H	H	H	H	2H	B
	密着性	0	0	6	10	10	10	10	10	10	10	10	0
	可撓性	×	×	○	○	○	○	○	○	○	○	○	○
	総合評価	×	×	○	◎	◎	○	○	×	×	×	×	×

*1 「UVI-6990」(ユニオンカード社製) : トリアリルスルホニウムヘキサフルオロホスフェート塩の混合物
(ビス[4-ジフェニルスルホニオフェニル]スルフドビスヘキサフルオロホスフェイトと
ジフェニル-4-チオフェノキシフェニルスルホニウムヘキサフルオロホスフェイトの混合物)

*2 「UVR-6110」(ユニオンカード社製) : 3,4-エボキシクロヘキシメチル-3,4-エボキシクロヘキサンカルボキシレート

*3 「DVE-3」(ISP社製) : トリエチレンジリコートンビニルエーテル

*4 「EOXA」(東亞合成製) : 3-エチル-3-ヒドロキシメチルオキセタン

*5 「APG-200」(新中村化学製) : トリブロビングリコールジアクリレート

*6 「IRGACURE651」(アズペシャルティケミカル社製) : ベンゾルジメチルカーボル

[0048] In addition, the measuring method and the evaluation approach of various physical properties are as follows.

- It measured at the measurement temperature of 25 degrees C using the viscosity rotation mold viscometer (MODEL DV-II made from BROOKFIELD+).

- Evaluating using the printer head of the printer for regurgitation stability ink jet recording methods (HS[by Brother Industries, Ltd.]- 5000), although the regurgitation was able to be carried out, x and the thing with printing nonuniformity made it as **, and what could carry out the regurgitation and did not have printing nonuniformity made O what was not able to carry out the regurgitation.

- Hardenability (pass)

After applying a constituent so that it may be set to about 15 micrometers at PET (polyethylene terephthalate), the black light (the product made from Eye Graphics eye MINIGU run daisy ECS-151U conveyor type) which installed the 80W /cm² high-pressure mercury-vapor lamp was passed, the count of passage until stickiness of a front face is lost was measured, and this count (this is called pass) was made into the index showing fast curability. In addition, the thing of measurement of pass is also called TFT (Tack Free Time) measurement.

- Use the sample which carried out one-pass UV irradiation further for the paint film produced on pencil degree-of-hardness TFT measurement and these conditions, and it is JIS. The pencil degree of hardness was measured according to K5400.

- Use the sample which carried out one-pass UV irradiation further for the paint film produced on adhesion TFT measurement and these conditions, and it is JIS. Adhesion was examined according to K5400. The adhesion test was performed by the X cut tape method, and the condition of X cut section after removing a cellophane tape estimated adhesion. An adhesion valuation basis is as in the following table 2.

[0049]

[Table 2]

<密着性評価基準（6段階評価）>

評価点数	Xカット部の状態
10	剥がれが全くない
8	交点に剥がれがなく、Xカット部にわずかに剥がれがある
6	Xカット部の交点からいざれかの方向に1.5mm以内の剥がれがある
4	Xカット部の交点からいざれかの方向に3.0mm以内の剥がれがある
2	テープを貼ったXカット部の大部分に剥がれがある
0	Xカット部よりも大きく剥がれる

[0050] - It scratched by the pawl from the background of the sample which carried out one-pass UV irradiation to the paint film produced on flexible TFT measurement and these conditions further, and the existence of peeling was investigated. The case where there were not x and peeling about the case where there is peeling was estimated as O.

- When it saw as ink of the printer for comprehensive evaluation ink jet recording methods, and many engine performance was excellent especially among those which obtained evaluation of O and O when one of physical properties had crossed tolerance and x and all the physical properties were in tolerance, it was estimated as O.

[0051] Next, Table 1 is explained. The comprehensive evaluation of each of No.1-2 and No.9-11 was x. That is, in too little [the rate that the component (2) to the AUW of component (2) - (4) occupies] No.1-2, it was the hypoviscosity of 20 or less mPa-s, and although excelled in regurgitation stability, the problem was in adhesion. On the other hand, although No.9-11 with the above-mentioned excessive rate showed fast curability, a pencil degree of hardness, adhesion, and a good result by flexibility, viscosity is high and regurgitation stability was bad.

[0052] On the other hand, the above-mentioned rate of No.3-8 was proper, and the comprehensive evaluation of all was O or O (that is, No.3-8 are equivalent to the example of this invention). That is, it is the hypoviscosity of 35 or less mPa-s, and regurgitation stability showed the good result in fast curability, a pencil degree of hardness, adhesion, and flexible all the comparatively good top. Especially No.4-6 were the hypoviscosity of 20 or less mPa-s, and its regurgitation stability was very good.

[0053] By the way, it is clear from the result of No.1-11 that a correlation is between viscosity and regurgitation stability. That is, to regurgitation stability getting worse, when viscosity exceeds 35 mPa-s, when viscosity is 35 or less mPa-s, comparatively good regurgitation stability is acquired, and when especially viscosity is 20 or less mPa-s, very good regurgitation stability is acquired.

[0054] Here, drawing 1 is the graph which took the viscosity of a constituent for the rate that the component (2) to the AUW of component (2) - (4) occupies, along the axis of ordinate for the axis of abscissa. Moreover, drawing 2 is the partial enlarged drawing of this drawing 1. In this graph, when asked for the above-mentioned rate in case viscosity is 35 mPa-s, it was 63 % of the weight. That is, as for the field where regurgitation stability is comparatively good, it turned out that the above-mentioned rate is 63 or less % of the weight of the range. Moreover, in this graph, when asked for the above-mentioned rate in case viscosity is 20 mPa-s, it was 53 % of the weight. That is, as for the field where regurgitation stability is very good, it turned out that the above-mentioned rate is 53 or less % of the weight of the range.

[0055] In addition, in this case, although it was the constituent which No.12 contain component (1) - (3) and does not contain a component (4), although viscosity was comparatively low, the result which is not desirable was obtained by adhesion.

[Experiment No.13-16] experiment No.13 - component [per 16] (2) - (4) and (6) were shown in the following table 2, carried out weight section weighing capacity, it mixed at the room temperature, and the mixture was moved to the dark room. And the component (5) was supplied to the mixture in the dark room, and heating

fusion was carried out. Heating fusion was carried out here because a component (5) was a solid-state at a room temperature. After cooling until it became a room temperature after that, the component (1) was added and it considered as the energy-line hardening setup-of-tooling product for ink jet recording methods.

[0056] Viscosity, regurgitation stability, hardenability (pass), a pencil degree of hardness, adhesion, and flexibility were investigated about the class product. The result is shown in the lower berth of Table 3. In addition, about each physical properties, it is already explanation ending.

[0057]

[Table 3]

成分	商品名	NO. 13	NO. 14	NO. 15	NO. 16
(1)	UVR-6990 ^{*1}	—	4	4	4
(2)	UVI-6110 ^{*2}	—	42(60.0)	50(62.5)	56(73.7)
(3)	DVE-3 ^{*3}	—	18(25.7)	20(25.0)	20(26.3)
(4)	EOXA ^{*4}	—	10(14.3)	10(12.5)	—
(5)	APG-200 ^{*5}	100	30	20	24
(6)	IRGCACURE651 ^{*6}	4	2	2	2
物性	粘度(mPa·s)	12.0	17.4	27.0	56.0
吐出安定性	○	○	△	×	
硬化性(△)	1	1	1	1	
鉛筆硬度	2H	H	H	H	
密着性	0	10	10	10	
可撓性	×	○	○	○	
総合評価	×	◎	○	×	

*1～*6は表1の欄外を参照。

なお、NO. 14～16の()内の数値は、成分(2)～(4)の総重量に対する
成分(2)の占める割合である。

[0058] Table 3 is explained here. Although the thing lacking in No.(1) whose 13 is indispensable component of this invention - (4), and the rate that the component (2) to the AUW of component (2) - (4) occupies No.16 are 73.7 % of the weight, the comprehensive evaluation of all was x. That is, it was the hypoviscosity of 20 or less mPa-s, and although excelled in regurgitation stability, adhesion and flexibility were bad at No.13 which lacked the indispensable component of this invention. On the other hand, although No.16 with the above-mentioned excessive rate showed fast curability, a pencil degree of hardness, adhesion, and a good result by flexibility, viscosity is high and regurgitation stability was bad.

[0059] on the other hand, No. -- the above-mentioned rate of 14 and 15 was proper (No.14 are 60.0 % of the weight, and No.15 are 62.5 % of the weight), and the comprehensive evaluation of all was O or O (that is, No. -- 14 and 15 are equivalent to the example of this invention). That is, all are the hypoviscosity of 35 or less mPa-s, and showed the good result in fast curability, a pencil degree of hardness, adhesion, and flexible all the top where regurgitation stability is comparatively good. Especially No.14 were the hypoviscosity of 20 or less mPa-s, and its regurgitation stability was very good.

[0060] In addition, as long as the gestalt of operation of this invention is not limited to the above-mentioned operation gestalt at all and belongs to the technical range of this invention, it cannot be overemphasized that various gestalten can be taken.

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] (1) The energy-line hardening setup-of-tooling product for ink jet recording methods characterized by the rate that contains an optical cationic initiator, the compound which has one or more oxirane radicals in (2) molecules, (3) vinyl ether compounds, and the compound which has an oxetane ring and one hydroxyl group in (4) molecules, and the above-mentioned component (2) occupies to the AUW of above-mentioned component (2) - (4) being 47 - 63 % of the weight.

[Claim 2] The above-mentioned component (2) Energy-line hardening setup-of-tooling product for ink jet recording methods according to claim 1 whose rate that the above-mentioned component (2) occupies to the AUW of - (4) is 48 - 53 % of the weight.

[Claim 3] The above-mentioned component (2) Energy-line hardening setup-of-tooling product for ink jet recording methods according to claim 1 or 2 characterized by the rate that the above-mentioned component (4) occupies [the rate that the above-mentioned component (3) occupies] 17 to 51.5% of the weight to the AUW of - (4) being 0.5 - 20 % of the weight.

[Claim 4] The energy-line hardening setup-of-tooling product for ink jet recording methods according to claim 1 to 3 characterized by for the above-mentioned component (2) being alicyclic epoxide, for the above-mentioned component (3) being JI or a TORIBI nil ether compound, and the above-mentioned component (4) being 3-alkyl-3-hydroxyalkyl oxetane (a carbon number being 1-6 pieces for an alkyl group and a hydroxyalkyl radical).

[Claim 5] Furthermore, the energy-line hardening setup-of-tooling product for ink jet recording methods according to claim 1 to 4 characterized by containing (5) light radical polymerization initiator and (6) ethylene nature radical polymerization nature unsaturated compound.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Component (2) It is a graph showing the relation of the rate and viscosity which the component (2) to the AUW of - (4) occupies.

[Drawing 2] It is the partial enlarged drawing of drawing 1.

[Translation done.]

* NOTICES *

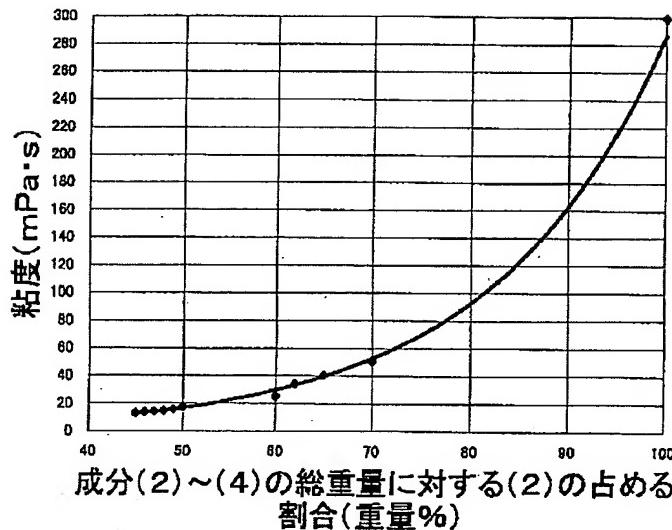
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DRAWINGS

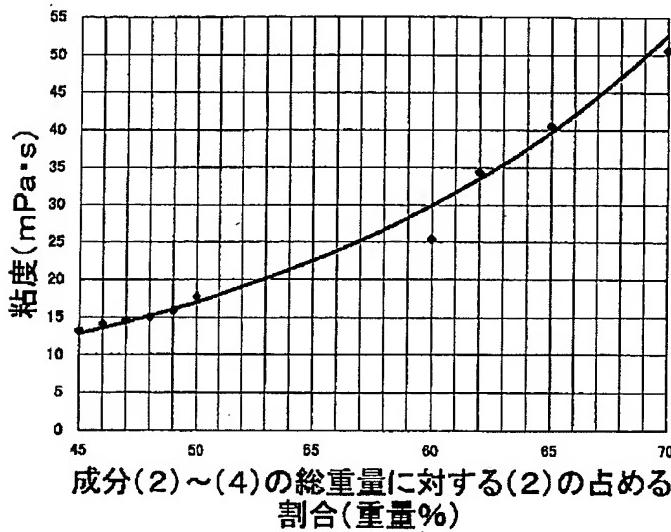
[Drawing 1]

粘度と成分(2)の含有割合との相関



[Drawing 2]

粘度と成分(2)の含有割合との相関



[Translation done.]